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Indian Standard

SPECIFICATION FOR CRANE SUSPENDED LADLES FOR IRON AND STEEL FOUNDRIES

PART 4 TAPER SIDED NON-GEARED LADLES 15 TO 50 TONNES CAPACITIES FOR IRON AND STEEL FOUNDRIES

(Second Revision)

UDC 621·746·323

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Indian Standard

SPECIFICATION FOR CRANE SUSPENDED LADLES FOR IRON AND STEEL FOUNDRIES

PART 4 TAPER SIDED NON-GEARED LADLES 15 TO 50 TONNES CAPACITIES FOR IRON AND STEEL FOUNDRIES

(Second Revision)

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SPECIFICATION FOR CRANE SUSPENDED LADLES FOR IRON AND STEEL FOUNDRIES

PART 4 TAPER SIDED NON-GEARED LADLES 15 TO 50 TONNES CAPACITIES FOR IRON AND STEEL FOUNDRIES

(Second Revision)

0. FOREWORD

0.1 This Indian Standard (Part 4) (Second Revision) was adopted by the Bureau of Indian Standards on 8 February 1988, after the draft finalized by the Foundry Sectional Committee, had been approved by the Structural and Metals Division Council.

0.2 This standard was first published in 1967 with a view to provide an economic degree of standardization in ladle capacities and dimensions, to ensure that the design and construction provide the maximum efficiency, safety and the minimum maintenance for steel and iron foundries, and was subsequently revised in 1975.

0.3 In this revision, depending upon the type, use and capacity, it was found convenient by the Sectional Committee to give more detailed requirements of these ladles from capacity 0·25 to 50 tonnes in the following four parts:

Part 1 Straight/taper sided geared ladles 0·25 to 10·0 tonnes for iron and steel foundries;

Part 2 Cylindrical geared ladles 0·25 to 3·0 tonnes for iron foundries;

Part 3 Straight ladles 0·25 to 3·0 tonnes for SG iron foundries; and

Part 4 Taper sided non-geared ladles 15 to 50 tonnes for iron and steel foundries.

0.4 This standard (Part 4) covers tapered shell non-geared ladles 15 to 50 tonnes. In large sized ladles, covered under this specification, generally it is not practical to operate the ladle with a gear box. Tilting is normally done with auxiliary hook of the crane engaging a tilting hook provided on the laddle. However, a gear box can be provided on smaller ladles covered in this specification, if so required by the purchaser.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960[*]. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the requirements of crane-suspended tapered shell, non-geared, ladles as shown in Fig. 1 in the capacity range of 15 to 50 tonnes suitable for steel as well as iron foundries.

1.2 Ladles covered in this specification may either be of flat bottom type or dished bottom type.

2. CAPACITIES AND DIMENSIONS

2.1 Ladles covered in this specification shall have capacities specified in Table 1 for both iron as well as steel foundries. The capacity of a ladle shall be its liquid iron or steel capacity (excluding slag) when lined with suitable lining material keeping minimum slag allowance as given in Table 1.

2.2 Table 2 gives shell dimensions of ladle for given liquid steel and iron capacities. The density of liquid steel has been taken as 6·89 g/cm^3 while that of liquid iron as 6·593 g/cm^3.

3. MATERIAL

3.1 Materials specified in this standard shall comply with standards given below:

Material	*Class/Grade and Specification*
Mild steel	IS : 226-1975[†] and IS : 2062-1984[‡]
Grey iron castings	Grade FG-200 of IS : 210-1978[§]
Steel castings	Grade 26-52 of IS : 1030-1982[‖]
Steel forgings	Class 2 of IS : 2004-1978[¶]
Phosphor bronze	Grade PBZ 10 of IS : 28-1985[**]

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[*] Rules for rounding off numerical values (*revised*).

[†] Specification for structural steel (standard quality) (*fifth revision*).

[‡] Specification for weldable structural steel (*third revision*).

[§] Specification for grey iron castings (*third revision*).

[‖] Specification for carbon steel castings for general engineering purposes (*third revision*).

[¶] Specification for carbon steel forgings for general engineering purposes (*second revision*).

[**] Specification for phosphor bronze ingots and castings (*fourth revision*).

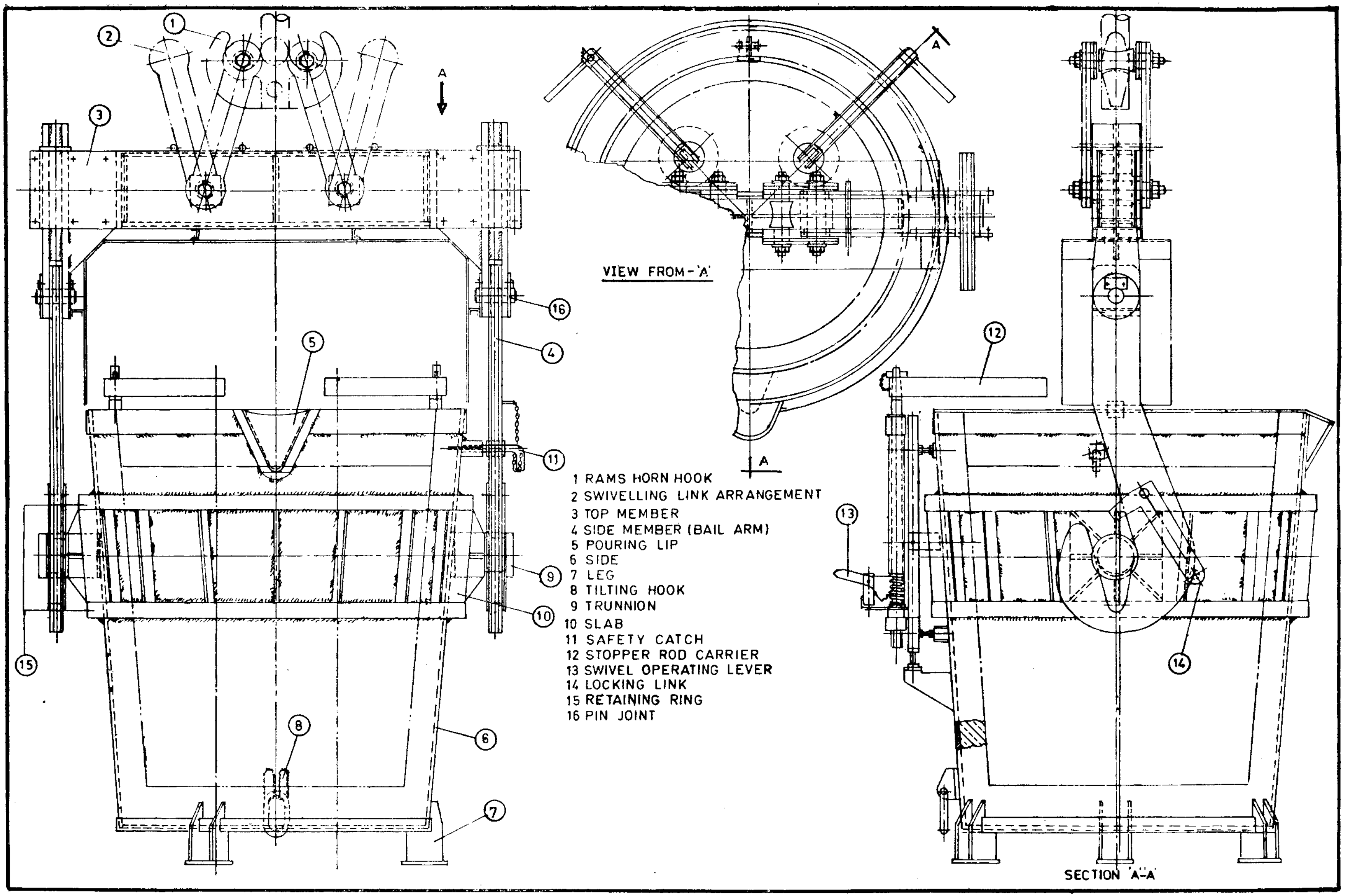

Fig. 1 Non-Geared Ladle

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TABLE 1 CAPACITIES, REFRACTORY LINING THICKNESS AND MINIMUM SLAG ALLOWANCES OF TAPER SIDED LADLES FOR STEEL AS WELL AS IRON FOUNDRIES

(*Clause* 2.1)

SL No.	CAPACITY IN TONNES	REFRACTORY LINING MEAN THICKNESS IN mm		SLAG ALLOWANCE IN mm
		Side	Bottom	
i)	15	150	180	280
ii)	20	150	180	295
iii)	25	170	210	300
iv)	30	170	250	320
v)	35	170	250	340
vi)	40	170	250	370
vii)	45	180	260	380
viii)	50	180	260	400

TABLE 2 SHELL DIMENSIONS OF TAPER SIDED LADLES

(*Clause* 2.2)

SL No.	CAPACITY IN TONNES	INTERNAL SHELL DIMENSIONS IN mm		
		Diameter at Top	Diameter at Bottom	Depth
i)	15	1 900	1 700	1 900
ii)	20	2 100	1 850	2 050
iii)	25	2 200	1 835	2 250
iv)	30	2 409	2 000	2 400
v)	35	2 420	2 020	2 500
vi)	40	2 480	2 070	2 700
vii)	45	2 570	2 160	2 800
viii)	50	2 680	2 200	2 900

4. BODY

4.1 The ladle body shall be of the mild steel plate and shall have thickness as specified in Table 3. The body will be fabricated from IS : 2062-1984*.

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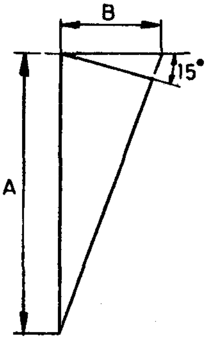
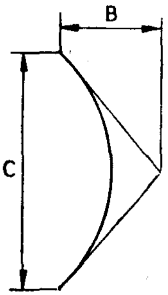
*Specification for weldable structural steel (*third revision*).

TABLE 3 SHELL PLATE THICKNESS, DIMENSIONS OF LIP FOR STEEL AS WELL AS IRON FOUNDRIES

(*Clause* 4.1)





Sl No.	Capacity in Tonnes	Shell Plate Thickness in mm		For Dished Bottom Ladles Bottom Plate Thickness	Lip Dimensions		
		Side	Bottom		*A*	*B*	*C*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	15	16	20	16	350	125	300
ii)	20	16	20	16	350	150	300
iii)	25	20	25	20	350	150	300
iv)	30	20	25	20	390	200	335
v)	35	25	28	25	390	200	335
vi)	40	25	28	25	390	200	335
vii)	45	28	32	28	450	230	385
viii)	50	28	32	28	450	230	385

4.1.1 The sides and bottom of the ladle shall be constructed by welding. The bottom plate shall be cut from a single plate. If more than one plate is used for the sides, the vertical joint should be staggered. There shall be no circumferential joint below the trunnion. All welded joints on side plates should be a double Vee butt joint. Vertical joints on the side plates should not be in the zone of 30° of the trunnion axis and the axis perpendicular to the trunnion axis.

4.1.2 The bottom shall be adequately secured by means of angle iron ring welded into position for flat bottom ladles.

4.2 The ladle body shall be suitably vented with 8 mm diameter drilled holes at 300 mm square pitch.

4.3 The sides of the ladle shall be reinforced with the help of two rings as shown in Fig. 1. These rings shall be suitably placed apart and shall be strengthened with the help of cross ribs welded to the ladle body in between the rings. The ends of the ribs shall be welded to the rings.

4.4 The body may either have a flat bottom or a dished bottom.

4.5 The ladles covered in this specification shall be provided with a renewable refractory retaining ring to the upper edge of the shell.

4.6 All welding shall be done in accordance with IS : 9595-1980*.

5. BAIL

5.1 The bail comprising the top members and side members (bail arms) and the hook shall be of rigid design as well as construction. The ladle should be designed such that, when lifted with the crane, the ladle will be in vertical position when filled with molten metal. In addition to this, the bail shall be so constructed as to permit the ladle to be turned through 360° about its trunnion axis.

5.2 The bail shall be of riveted welded or bolted construction.

5.2.1 The top member shall be formed of laminated or fabricated steel sections. If laminated, they shall be joined together with the help of rivets or dowels.

5.3 The side members (bail arms) shall be bolted, riveted or welded to the top member.

5.3.1 The bail arms may either be fixed to the trunnions or of the detachable type as shown in Fig. 2.

5.3.2 The bail arms shall be made of laminated steel plates joined together with the help of rivets from steel section or dowels or fabricated.

5.3.3 The detachable bail arm could either be of rigid or collapsible construction having a pivoted joint.

5.3.4 In case of the collapsible bail arm, the pin joint should be suitably designed. The pin should be of forged steel.

5.4 For the ladles covered in this specification, a laminated hook-eye shall be provided. The hook-eye shall be fabricated from plates conforming to IS : 226-1975†. These plates may either be riveted together or welded together. The hook-eye shall be designed and attached to the top member, so that the load is borne by the hook-eye and not by the fastening bolts or rivets. The hook-eye shall be positioned so as to ensure that the ladle is vertical, when full of molten metal, to its specified capacity.

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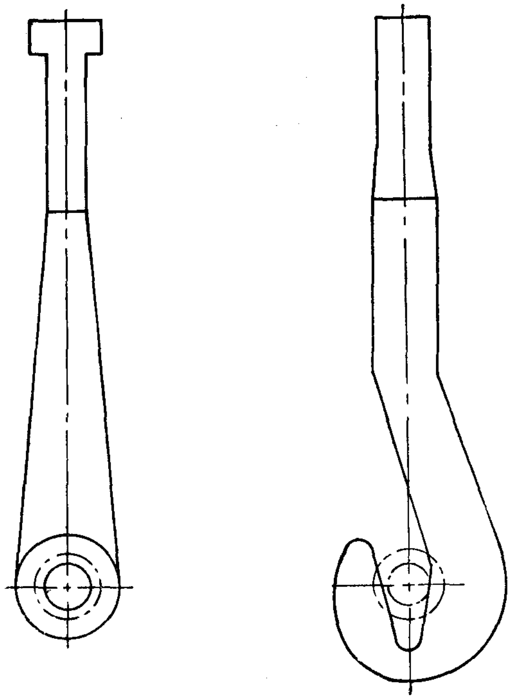
*Recommendations for metal arc welding of carbon and carbon manganese steels.

†Specification for structural steel (standard quality) (*fifth revision*).



Fixed Bail Arm Detachable Bail Arm

FIG. 2 BAIL ARMS

5.5 The ladles covered in this specification can be lifted with a ram's horn hook for which suitable swivelling link arrangement shall be provided or can be lifted with a C-hook for which laminated hook-eye shall be provided.

5.6 The hook-eye shall be sufficiently large to accommodate the lifting C-hook in use and shall have an adequate factor of safety.

5.7 The purchaser should specify the type and the capacity of the crane hook by which the ladle is to be lifted. The ladle lifting hook shall be designed to suit the same.

5.8 The bail arm should be protected from the radiation heat of the molten metal with a suitable heat shield.

6. TRUNNIONS

6.1 Two heavy steel slabs should be welded to the side of the shell at trunnion location. The slab should be held in between the welded retaining ring described in **4.3**. The trunnions shall be fitted on the coaxial bores, bored in the slab. Trunnions should be welded to the slab and to the inside of shell. Trunnion should be of forged steel.

6.2 The trunnions shall be so located that the ladle is balanced on the trunnion, when it is filled to its specified capacity.

6.3 The trunnions shall be protected against metal splashes by a suitable guard.

7. SAFETY CATCHES

7.1 Safety catches shall be provided which, when engaged, prevent movement of the ladle and cross member relative to each other when the ladle is hanging or standing in an upright or inverted position.

7.2 Safety catches shall be so designed as to operate freely and to be readily renewable when distorted in an unsafe condition.

7.3 Safety catches shall be so located on the side member that, when closed, the forks or pegs are engaged at a distance of not more than 150 mm below the top of the ladle body.

7.4 In case of ladles provided with the detachable bail arms a locking link is attached to the bail arm which holds the bail arm with the trunnion, for safety purpose.

7.5 Additional safety devices may be incorporated by agreement between the purchaser and the manufacturer.

8. TILTING ARRANGEMENT

8.1 As shown in Fig. 1, a tilting hook is welded to the ladle body to tilt the ladle with the help of the auxiliary crane hook.

8.2 This hook is welded to the ladle body on the opposite side of the lip.

9. LIP DESIGN

9.1 Ladles covered in this specification shall be provided with a single lip, the dimensions of which are given in Table 3. The lip may either be welded or bolted to the body. The purchaser shall specify at the time of enquiry whether the lip is to be welded or bolted to the ladle body.

10. OPENING FOR RECEIVING NOZZLES AND STOPPER GEAR FOR BOTTOM-POURING LADLES

10.1 Nozzles shall be located at a distance from the centre of the base of the ladle equal to one-third of the internal lined diameter of the base of the ladle. However, it shall be ensured that there is a minimum clearance of 50 mm between the edge of the nozzle and the inner wall of lining at the bottom of the ladle.

10.1.1 A detachable nozzle box for securing to the bottom of ladle may be provided as agreed to between the purchaser and the manufacturer.

10.2 Stopper operating gear shall be so constructed that, when the ladle is filled to its specified capacity with liquid steel or iron and the operating handle is attached, the stopper will not open without the operating handle being actuated. A locking screw or other similar arrangements shall be provided in a convenient position so that the stopper operating gear may be locked in the closed position.

10.2.1 The stopper gear shall be so designed that the operating handle is raised to close the stopper and lowered to open it.

10.2.2 The stopper gear operating lever shall be designed so that it may be operated at any point in a horizontal arc of not less than 120°.

10.2.3 Stopper rods may be supplied at the request of the purchaser.

10.2.4 The stopper rod carrier shall have a tapered hole at the top and the slide shall have a tapered shank as shown in Fig. 1.

10.3 If required by the purchaser, the ladle covered in this specification can be supplied with two bottom pouring arrangements.

11. FEET

11.1 Suitable feet shall be provided to ensure safety when the ladle is standing on the floor, either full or empty.

12. INSPECTION

12.1 Welded joints for the ladle covered in this specification shall be subjected to radiographic examination as shown below (*see* IS : 1182-1983* and IS : 2595-1978†):

a) *Bottom Plate to Side Plate Weld* — 25 percent of the weld length by random sampling.

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*Recommended practice for radiographic examination of fusion welded butt joints in steel plates (*second revision*).

†Code of practice for radiographic testing (*first revision*).

b) *Side Plate Weld* — 10 percent of the weld length by random sampling.

c) *All T Joints* — 100 percent of the joints.

12.2 The forgings and castings used in the ladles shall be radiographically/ultrasonically examined (*see* IS : 2995-1978* and IS : 7666-1975†).

13. MARKING

13.1 Each ladle shall be clearly marked with the manufacturer's name or trade-mark, serial number and the capacity of the ladle along with the term 'Iron or Steel' indicating that the ladle is meant for the respective foundry.

13.1.1 The ladle may also be marked with the Standard Mark.

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. BIS marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers, may be obtained from the Bureau of Indian Standards.

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*Code of practice for radiographic testing (*first revision*).

†Recommended procedure for ultrasonic examination of ferrite castings of carbon and low alloy steel.

(*Continued from page* 2)

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